

★ Medical Causes of ED:

I-ED associated Systemic Diseases :-

A. CVS :- clear association Between ED, CVS

- In ptn Coronary artery Disease
Coronary bypass Surgery
Peripheral vascular Disease
Hypertension

• The aggravating Factors of ED in those ptn include :-
• Smoking • Aging
• DM • Hypercholesterolemia • Drugs that used in tte.

• General tte :-

1. Correction → of the Risk Factors to prevent Further Damage of the penile vasculature
2. Cooperation → Between the andrologist and Cardiologist

as Regards of ptn life style, Safe Sexual life in Relation to his Heart Disease

• Specific treatment :-

↳ @non-surgical tte :-

1- Oral erectogenic Drugs :- Sildenafil (viagra)
- Its contraindicated in ptn e Nitrates therapy for Coronary Heart Disease

2- Intracorporeal Drugs

• Papa Verine → Better to avoided D it its High incidence of Systemic Side effects

Hypotension Vasovagal Reflex

Specially if there is Veno-occlusive dysfunction

• Prostaglandin E₁ (Prostin VR)

- more safe - alternative when used in Small Doses (5 µg) with Occlusion of the Penile Base By rubber Band to Fix it in Corporeal tissue

- If Those Cardiac ptns Develop Prolonged erection → they are at High Risk During treatment of prolonged erection Due to effect of the vasoconstrictor agents on their heart Disease.

→ The first agent of choice in this Condition is [Phenylephrine] → Because ~~As~~ it has Least Cardiogenic effect.

→ The Second agent is [Dopamine Hydrochloride]

↳ (b) Surgical treatment:

- Implantation of penile prostheses (Avoided) → in all ptns &
 - Artificial Heart valves
 - arterial prostheses
- to avoid the possible Risk of their Haematogenous infection after operation

B. Respiratory Disease:

1- Sleep apnea & heavy snoring →

are chch By: arterial Hypoxia and ⁽²⁾ HyperCapnia & pulmonary - Systemic Hypertension

2- Chronic Obstructive pulmonary Disease (COPD) → may have ED in up to 30% of them despite their normal penile Vasculature which suggests that the pulmonary Disease is the primary aetiological factor.

C. Hepatic Disease :-

1- Chronic liver Diseases → may associated with ED about 50% of ptn

- the incidence is Higher in alcoholic liver Cirrhosis 70% than in other non-alcoholic conditions 25%.

2- The mechanism of ED

↳ Hyperprolactinemia

↳ High level of Sex Hormone Binding globulin (SHBG) → lead to low level of the bioavailable testosterone

↳ High level of estrogen that inhibit LH secretion

↳ if liver cirrhosis caused by Alcoholism
→ there may be Direct Toxic effect on the hypothalamus and pituitary gland

3- If ICI therapy to be used → Gonadoreline should be Avoided Due to its potential systemic side effects on liver

4- Prostaglandin E₁ (prostin VR) is the most safe agents

D. Renal Disease:

a The incidence of ED among ptns w/ Renal failure → up to 50%.

- it's also associated with
↳ Low Desire
↳ Infertility

b The mechanism of ED :- (3)

↳ 1- endocrinal Disturbances of hypothalamic-pituitary-testicular axis with :-

- High level of prolactin, FSH, LH
- Low level of Testosterone.

- The High prolactin level Due to :

- ↑ production
- ↓ clearance
- Dit Drugs such as → methyldopa
↳ Digoxin
↳ Cimetidine

- This disturbance persist During Dialysis But improve after renal transplantation

↳ 2- Vascular Disorders :

- arterial occlusion Due to
↳ accelerated atherosclerosis
↳ Veno-occlusive dysfunction

3. Neurological Disorders :-

- autonomic - Somatic neuropathy

4. Other factors:

- severe anemia - Zinc deficiency
- ↑ parathormone - DM - psychis Stress
- Drugs as :- Anti Hypertensives

The treatment:

non-surgical

Surgical

Pharmacological

- androgen Replacement Therapy
- prolactin inhibitory Drugs
- Zinc supplement
- Recombinant erythropoietin for anemia

ICI Therapy

- effective + safe even after renal Transplant
- High Doses may needed in ptn w/ occlusive arterial Disease
- ptn w/ venous occlusive Dysfunction → may Not Respond.

→ Renal Transplant :-

- Result in Restoration of erectile function up to 80% of ptns
- ED may persist after Renal Transplant which may be ~~due~~ the ligation of internal iliac artery During transplantation → to be used in the anastomosis
- The Risk of this ED ↑↑ after the 2nd Transplant
- Recommended ↓
e external iliac artery to prevent complications

→ penile implant:

- the Best alternative if ED doesn't improve after Renal Transplant
- ↑ potential of prosthetic infection in some ptns Due to :- immunosuppressant Drugs

III

E. Metabolic Disease:

Hemochromatosis

- autosomal Recessive disorder
- progressive accumulation of IRON in tissues.
- Including pituitary gland & testes
- manifestations appear around age of 40-60 yr
 - ↓↓ Sexual Desire
 - ED.
 - Bronzed skin
 - DM
 - Hepatosplenomegaly
- High serum level of IRon
- High transferrin Saturation

Amyloidosis

- Hereditary Type
- Involve the Autonomic nervous system
- Leading to: Neurogenic ED
- No specific Therapy
- The Cause of Death Due to Renal Failure

II - ED associated Therapeutic Drugs

A. CNS Drugs:- ⑤

(a) Sexual Side effects:-

- ↓↓ Sexual Desire.
- ED
- ejaculatory Dysfunction
- Priapism.

(b) Mechanism:-

- Sedation - anticholinergic effect
- Central dopaminergic antagonism
- Central adrenergic antagonism
- Hyperprolactinemia

(c) Examples:

- major Tranquilizer: phenothiazines
- minor tranquilizer: Diazepam (not clonazepam)
- all sedatives and hypnotics:-
barbiturates - meprobamate
- Anti Depressants:-
 - MAOI - TCAs - lithium
 - The antidepressant Fluoxetine (Prozac)

that act By selective Serotonin Reuptake
⑥ inhibitors (SSRI) → may lead to ED.

Improved By: concomitant use of

Yohimbine

- The antidepressant Trazodone →
associated w/ priapism

B. CVS drugs:

① Antihypertensive Drugs

● Mechanism:- (General)

- The hypertension have pathological
changes in their arteries.

- Such as arteriosclerosis.

[muscular hypertrophy of their wall]

● ↑↑ Vasomotor tones + atherosclerosis

[intimal plaque] → That may prevent proper
Cavernosal arteries Dilation.

- The Anti-Hypertensives → Reduce BP
Below critical value. That is needed
to obtain or maintain enough

Blood Flow through the Cavernosal
Vessels.

- This is because The Cavernosal Vessels
Disease need BP Higher than normal
For their Dilation

● (Specific) mechanisms:

② * Diuretics:

↳ Thiazides: associated w/ ED,
Incidence varies from 9% of the ptn to 31%.
Because they don't have Vasodilator effect.

↳ Spirolactone:

- anti-androgenic effect → loss sexual desire
↳ ED
↳ Gynecomastia

③ * Direct Vasodilator:

↳ Hydralazine - Minoxidil →

- used in combinations w/ other
antihypertensives

- minoxidil → induce erections in some ptns

* α -Blockers: (non-selective α -adrenergic Blockers)

⑦ \rightarrow Phenoxymethamine:
 \rightarrow Prazosin: (new selective α_1 -adrenergic Blocker)

- rarely associated eED, But they may lead to emission - ejaculation failure

* B-Blockers:-

\rightarrow Propranolol: \rightarrow desire inhibition
 \rightarrow ED

- Through Both \rightarrow peripheral action on Cavernous Tissue

\rightarrow Central action on CNS

\rightarrow Atenolol: new B-Blocker

- water soluble - lesser penetrate to CNS compared to propranolol (lipid soluble)

- Cause less impairment of Sexual Function

* ACE inhibitors: \rightarrow Captopril

- promising group of antihypertensives.

- Because The Drugs of This group \rightarrow

may Reduce the hypertrophy of the arterial wall.

- lead to improvement of erectile function

* Ca. Channel Blocker:-

\rightarrow Verapamil:

- This group Not usually associated eED

- They need more evaluations as someptn Reported ED w/ Verapamil

* Central-peripheral Sympatholytics:

\downarrow
Clonidine

reserpine

methyldopa

\downarrow
guanethidine

- may lead to ED, ejaculatory Dysfunction through their Central inhibitory effect.

- Reserpine + Methyldopa \rightarrow may lead to

• Sedation • depression • Hyperprolactinemia

- most of them Rarely used nowadays

B. Anti-Hyperlipidemic Drugs

* Clofibrate (Atromid)

* gemfibrozil (Lopid)

Interfere with the synthesis of steroid hormones
→ Sexual Desire
→ ED

C. Anti-Heart Failure Drugs

→ * Digoxin

→ low sexual Desire + ED Through
↓ testosterone ↑↑ estrogens
↑↑ intracellular Ca in the Corporal
smooth muscles + ↑↑ muscle
Tone

C. Digestive System Drugs :-

→ Cimetidine (Tagamet)

→ Ranitidine

- used in the of peptic ulcer

- may be associated with ED, gynecomastia

- Cimetidine → may inhibit the sexual functions By → elevation of prolactin level and peripheral histamine (H₂) receptors → Blocking in the cavernous smooth muscles

D. Hormones :-

→ GnRH analogs :- ^{Goserelin}
Leuprolide acetate

That used in the of Benign prostatic Hyperplasia (BPH) → lead to ED

→ Oestrogenic compounds :

used in the of prostatic Carcinoma → ED

E. Anti-Hormones :-

→ Drugs with antiandrogenic activity → ED

→ These drugs may inhibit testosterone synthesis such as → Ketoconazole

inhibit testosterone action → Cyproterone

acetate → used to treat sex offenders depend on its inhibitory effect on sexual function

↳ Proscar (Finasteride) :-

- Inhibitor of 5- α Reductase enzyme
- Used in the of BPH.
- may be associated \bar{e} ED in few pts

↳ Flutamide :

- inhibit androgen Receptors
- has minimal effect on potency.

III - Ere.D associated or Non-Therapeutic agents:

(A) Tobacco :-

(a) Acute effect of smoking :

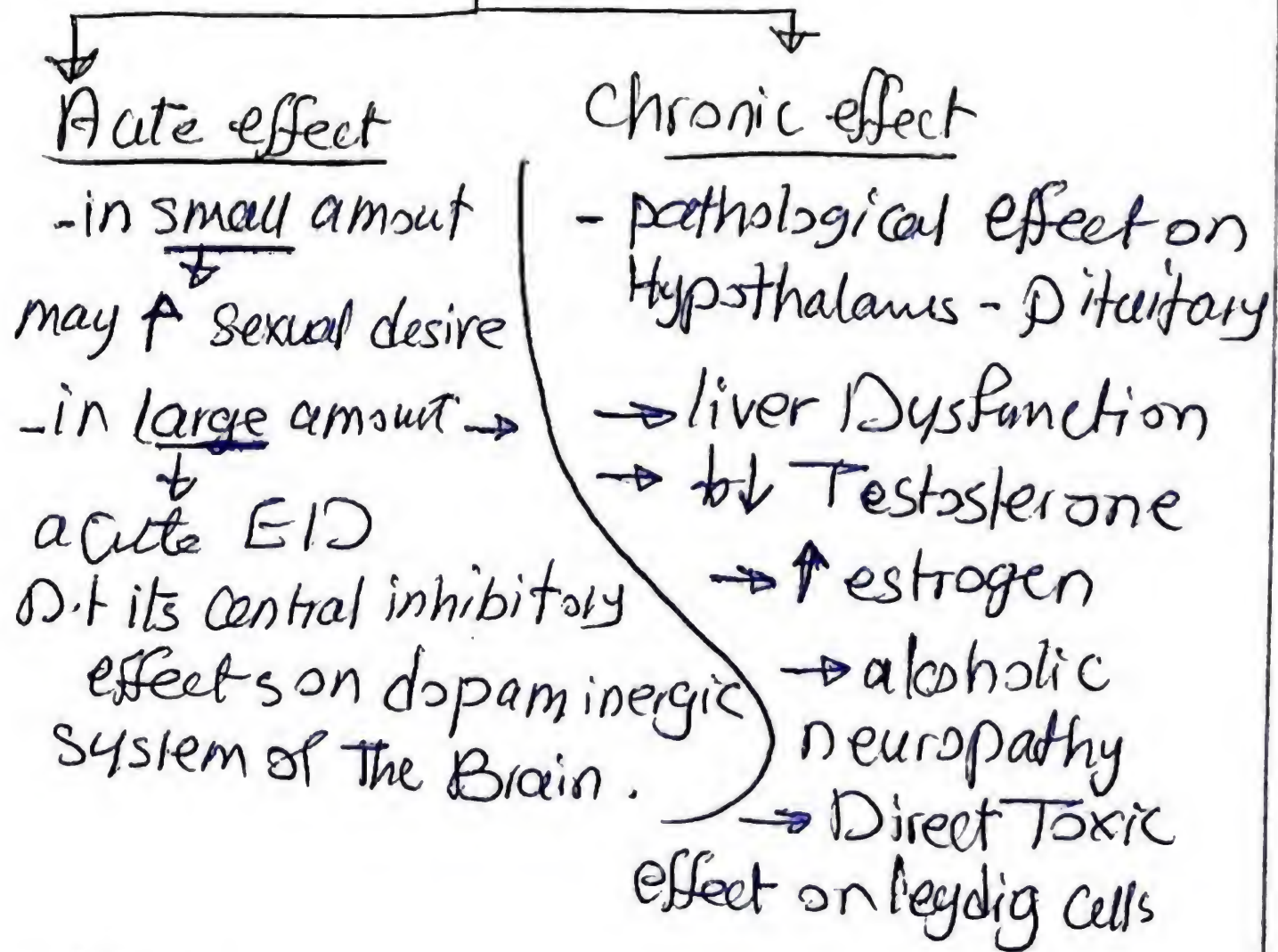
- Acute vasoconstriction
- Disturbance in veno-occlusive mechanisms of cavernous tissue
- ICI test with papaverine Done immediately after smoking 2 cigarettes

→ lead to failure of erectile Response in the Test

(b) Chronic effect of smoking :- (7)

- inverse correlation Between the number of Smoked cigarettes per day and Rigidity and Duration of nocturnal erection.
- The weakest and shortest erections occur in men who smoke more than 40 cigarette per day
- Because Smoking is an important Risk factor For Atherosclerosis
- The effect of Smoking on ED → aggravated when there are Other Risk Factors
 - ↳ advanced age
 - ↳ Hypertension
 - ↳ Heart Disease
 - ↳ Cardiac medications

B) Alcohol



C) Cannabis:-

- large acute Doses & Chronic use of Cannabis (marijuana) seriously interfere with normal erectile function and fertility
- mechanism involved :- depressive.

effect on the metabolite :- (10)
Tetrahydrocannabinol on the
nervous system
+ Reduction of Serum Testosterone

D. Opiates:

- derivatives such as Opium & Heroin
lead to → ED
Through nervous system depression
+ Hyperprolactinemia

E. Cocaine:

Cause ED by mechanisms similar to
Cannabis, opiates



Etiology:

(A) Brain lesions:-

- (a) Cerebral Stroke (accidents) Variable incidence of ED in men & Cerebral accidents D.t →
- Trauma • Tumors • Vascular accidents
 - That depend on involved area of stroke
 - This may be disturbance in the desire or erection Specially if the affected area is in the Right Cerebral hemisphere in which the sexual functions are more represented than left hemisphere.

(b) Epilepsy:

- Temporal lobe epilepsy → & ED because the temporal area is one of the Regulatory areas of sexual function

- may be associated :- Hormonal disorders in temporal lobe epilepsy in the form of:
 ↓↓ gonadotrophins ↑↑ prolactin

(C) Multiple Sclerosis :- (MS)

- upto 71% of ptns & MS → have ED
- The involved sites : may be in the high Centers of Brains OR in spinal cord.
- ED occur if the Disease affect the Sexual areas of the High Brain Center OR the Sacral areas of the Spinal Cord.
- ED associated :- Bladder dysfunction
- ED in ptn & MS may have Both :-
Neurogenic - psychogenic Basis as in
- Some ptns & MS → There was No Relation Between ED and Nocturnal erections

④ Multiple System Atrophy (MSA)

(Shy-Drager syndrome)

- manifestations of Autonomic failure in the form of:
 - Postural hypotension
 - Bladder Dysfunction.
 - ED

- This Syndrome Considered of one manifestation of more widespread affection of nervous system known as (MSA)

- includes:
- Parkinsonism
 - Cerebellar ataxia
 - Autonomic failure

B. Spinal Cord lesions :-

① Traumatic lesions:-

- Spinal cord injury associated with:
 - ↓ desire
 - ↓ frequency of sexual activity
 - Psychological disturbance

② - The acute injury of the spinal cord is associated in the Early phase with the Spinal Shock → Ch. ch By:

- Complete absence of genital, Rectal and Bladder reflexes

{ This is a temporary phase
→ The prognosis should Not be given in this Early stage after which many functions can be retained again.

- The Late Sexual dysfunction → depends on the level and Completeness of the injury

→ in men with Complete Upper Motor neurone lesions

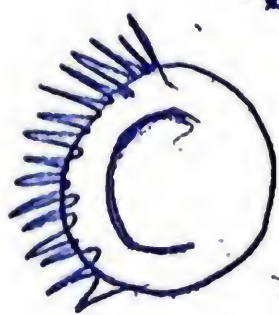
- The Reflex erection is preserved
- psychogenic erection → diminished

③
↳ in men with injury at the lumbar region → the reflex erection → absent
↳ Psychogenic erection → preserved

↳ men with complete sacral injury → Has the worse prognosis with No erection or ejaculation

(b) Non-Traumatic lesions:-

- other lesions as → Disc herniation
 - ↳ Syringomyelia
 - ↳ MS
 - ↳ MSA
- ↳ spinal bifida
- ↳ Tumours



Peripheral Nerves lesions:-

(a) Traumatic lesions:

- non-iatrogenic injury as in pelvic fractures → Result in injury of the Cavernous arteries or nerves.

- Iatrogenic injury may occur in:-

- Transurethral resection of prostate TURP
- Urethrotomy • Urethroplasty
- Iatrogenic injury to Cavernous nerves → may occur in radical operations For:
Carcinoma of Bladder, Prostate, Rectum.

- modified Nerve Sparing Technique For:
Prostatectomy led to → Reduced incidence of ED

(b) Non-Traumatic lesions: (Peripheral neuropathy)

- The most common Cause of neuropathy that led to ED is → Diabetic neuropathy
- Other important Causes

- Uraemic neuropathy
- amyloid neuropathy
- alcoholic neuropathy

- Infective neuropathies → may lead to ED include
 - ↳ Leprotic neuropathy
 - ↳ AIDS associated neuropathy

① Diagnostic Tests of Neurogenic ED :-

(A) Clinical Tests:

1 History - Examination

2 Specific Diagnostic Clues :-

- ↳ The Cause may be found in the History :-
as DM, Pelvic, Spinal Trauma
- ↳ The Complaint of the ptn may help to suspect the affected nerve as:
 - If the affection of the autonomic cavernous nerve → complain of Loss of the initiation of erection
 - If the affection of the Sensory part

of the puddendal nerve → Complain (1) of Loss of maintenance of erection
(Known as Dorsal nerve ED. Due to Loss → Continuous Sensory Stimulation During coitus that is transmitted By This nerve.

- If there is affection of Motor part of puddendal nerve → ptn complain of Loss of the Rigidity of erection D.t: Loss of Contractions of perineal muscles Supplied By This nerve,

3 The physical examination →
Reveal → Absent OR Reduced reflexes and sensations

(B) Screening Tests :-

- 1 ICI test :- The erectile response to
The ICI Test is an exaggerated Response

explained By: The ptn e' neurogenic pathology may have denervation Supersensitivity

[2] Rigiscan monitoring:- help to distinguish ptn e' psychogenic ED which may have Normal Response to ICI Test

[3] Biothesiometry!

- The biothesiometer:- portable electro magnetic device → deliver various amplitudes of vibratory stimulation to measure → the sensory perception in penis

- Done By: placing the tractor of the device on the Reference sites
→ pulp of index fingers and then is put in test sites

that are the:- Right & left sides of penile shaft and glans ⑤

to Compare the Difference in sensory perception Between the test sites and reference site

- When that difference is Abnormal → then more specialized neurophysiological tests to be Done.

- The biothesiometry Can't replace these neurophysiological studies. Due to the fact that the vibration is not an adequate stimulus for the glans that contains very few vibratory Receptors.

① Specialized Neurophysiological Tests:-

- Reserved for → Selected ptns in those above mentioned clinical & Screening Tests Revealed evidence of neurogenic defect.

① Somatic Nerves Studies :-

⑥

Bulbo Cavernosus reflex (BCR) latency

- test performed By placing
2 Stimulating Ring electrodes
one near The Colonal sulcus
other is 3 cm proximal to it.

- Then 2 recording needle
electrodes placed in the
Right and left bulbo-
Cavernos muscles to
Record The Response.

- Normally :- There is
latent period Between
the application of the
Stimulus and the
recording of The Response

- BCR latency → prolonged
= neurogenic Dysfunction

Dorsal nerve Conduction Velocity

- 2 measurements of The
BCR latency tests are
obtained
- One from the glans
one from Base of penis

- The Conduction Velocity
of the Dorsal nerve of
The penis obtained as :-

= Distance Between the stimulating electrodes
Difference in the latency time Between the Base
and the glans

Genitocerebral evoked Potential tests

- The stimulating electrodes are
Put as in the usual BCR latency
test
- But the Recording electrodes are
Put on the
and → Sacral spinal cord
→ Cerebral Cortex
to Record The evoked Response.

↓
The Response here is
Recorded By :

EEG

- while in BCR latency is
Recorded By EMG

(b) Autonomic Nerve Studies:

(7)

Single potential analysis of cavernous electrical activity

SPACE

- test depend on Recording the Cavernous electrical activity Through the Cavernous EMG
- Ch. ch By: reproducible wave forms (potentials) in the Normal men
- These (potentials) have peak amplitude Between 120-500 mV
- mean Duration of 12 sec

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Cardiovascular Response

- test Done to evaluate the heart Rate Response and Blood pressure Response to quiet and deep Breathing and Change in posture.

- These Responses depending on the autonomic nerves

↳ So they are indirect Test for Autonomic nerves to the penis.

- They may be affected By many External Factors; thus they have to be Standardized.

- The penile autonomic nerves have longer course compared to The Autonomic nerves of CVS.

- excessive length of Cavernous nerve → more liable to early involve in Neuropathy.

Sympathetic Skin Response SSR Tests

- Test measures the skin potentials evoked By electric stimulation That Can be applied to the tibial or median nerve and the evoked potential Recorded at the Foot or The penis

- Its Useful method in Testing the Penile Autonomic innervation

① Treatment of neurogenic ED :

②

A. Non-invasive Therapy

- depends mainly on:- Early Recognition and treatment of the possible Neurogenic Causes.
- Because late Cases of nerve Damage → Irreversible
- Example:
 - ↳ Stop Alcohol intake
 - ↳ Strict diabetic Control
 - ↳ Correction of uremia
 - ↳ All of any diseases affecting the Vertebral disk

B. Intracavernous Therapy

- Suitable for ptns w' irreversible nerve Damage
- Ptn usually have Very good Response to Lower Doses of Vasoactive Drugs as compared to ptn w' ED Resulting from: other Causes of the denervation SuperSensitivity

C. Surgical Therapy

- Used in ptns who Refused or failed to Continue on ICI Therapy
- Insertion of penile prosthesis is good alternative.
- If ptn have Condom Catheter for urinary incontinence as in some paraplegic ptns
- The Semi Rigid prosthesis is Better to be used for Better fixation of the Catheter.
- Strict Aseptic Conditions are needed Because the potential of infection is higher in the Ptn with Spinal Cord injuries.

★ VASCULOGENIC ED

① Terminology

• ED Caused By: any occlusive disease that affect the penile arteries in the presence of normal corpora cavernosa - occlusive mechanism

• as a Result of The Failure of Penile filling with Blood → There may be ↑↑ in the time needed to attain erection and ↓↓ in the Rigidity of the erection

② Etiology of arteriogenic ED:-

I- Non-Traumatic Arterial Occlusions:-

1- Iatrogenic Causes: Antihypertensive Drugs

II- Arteriogenic erectile D

2- Non-Iatrogenic Causes:-

① Hypercholesterolemia:

- associated with atherosclerosis of the Blood Vessels → occlusions of their lumen By Cholesterol deposition the intima.

- ED occur when this occlusion affect > 75% of the diameter of the penile vessels.

② Hyperglycemia (DM):

- associated with angiopathy of the small Blood Vessels → Occlusion of their lumen

- this angiopathy is specific for diabetes and Caused By:- Thickening of the Basement membrane of the vessels membrane of the vessels

- Its closely related to other diabetic complications as Retinopathy.

- the large vessels in diabetes may show : accelerated atherosclerosis

③ Hypertension:

- associated w/ arteriosclerosis of the Blood vessels \Rightarrow narrowing of their lumen
- By \Rightarrow Sclerosis of the muscle layer of their wall.
- The end Result is ED
- antihypertensive Drugs \Rightarrow ED

④ High age group:

- Presbyrectia \Rightarrow \downarrow erectile activity in men During old age
- explained By \Rightarrow progressive arterial atherosclerosis in the old age.
- This lead to \Rightarrow Corporeal hypoxia which leads to \Rightarrow Degeneration of the Corporeal smooth muscles and their replacement by Collagen

- There is progressive \downarrow of the erectile function in old age.

⑤ Habits:

- Smoking \Rightarrow V. important Risk factor For ED
- These effects may be Acute d.t arterial VasoConstriction.
- Smoking 2 cigarettes \Rightarrow Immediately Reduction of erection after ICI of papaverine
- Chronic Smoking \Rightarrow aggravate other Vascular risk Factors :-
 - \hookrightarrow atherosclerosis , HTN.
- It may also lead to \Rightarrow Veno-occlusive dysfunction By its Contractile effect on the Cavernous Smooth muscles.

II Traumatic arterial occlusions :-

- 1- Iatrogenic Trauma : occur During The surgical operations in abd. or pelvic Vessels

as: aortofemoral bypass
aortoiliac bypass
During Renal Transplantation.
- It may occur after pelvic irradiation
as a ttt for ptn & prostate Cancer

2- Non-Iatrogenic Trauma:-

- Blunt perineal - pelvic trauma → focal stenosis of the common penile or cavernosal artery.
- It occurs also in → men who are bicycle riders

* Syndromes & arterial erectile dysfunction:-

• Leriche Syndrome:

- Caused By: Thrombotic obliteration of the aortic bifurcation ⇒ ED
- Ischemia + Claudication pain in the gluteal Region + thigh

• Iliac (pelvic) Steal Syndrome:-

- Caused By: atherosclerosis of the iliac arteries
- the ptn has "initial" good Reaction erection → But once the active coital "Movements" start There is loss of this erection

- explained as follows: Due to atherosclerosis → There is Collateral circulation that can compensate for this at rest

So → erection is good

However the active coital movements will deviate or "Steal" this Blood into the thigh muscles → leading to → Pelvic Ischemia + ED.

C. Diagnosis of arteriogenic ED

- The following important points:

• History: - may have failure to initiate the erection or to have Rigid erection

- erection may be lost During active coital movement

(b) Examination:

- evidence of Hypertension, absent or weak peripheral pulsation or scars of pelvic operation

(c) Differentiation Between Organic and psychogenic factors

↳ ICI - CIS test:

- Slow erectile response that is delayed for more than 30 minutes or lack of Rigidity

• The anxious ptns → have same Result in absence of arterial Disease

→ These false Results → may overcome by the combined injection and stimulation Tests CIS Test

↳ There is additional stimulation 15 mins after the injection either By:
manual self-stimulation or By audiovisual sexual stimulation

- In doubtful cases → Rigiscan is helpful

(4)

↳ • Rigiscan Testing ↓

- show evidence of Organic arterial disease

(d) Detection of the arterial Causes

1 Non-Invasive Tests:-

• [pharmacopenile Duplex US]
PPDU

a. examination During Placid phase

- used to image the Corpora Cavernosa & Corpus Spongiosum & tunica Albuginea
- Normally: The Cavernous artery diameter is 0.5mm & and the Corpora should have a Homogenous uniform echogenicity

- Abnormal conditions → Fibrosis -
Calcification in the form of echo-dense
areas as in penile fibrosis or in
Peyronie's Disease.

1b) Examination During pharmacologically induced erection :-

- Normally: within the first 5 minutes of
ICI of vasoactive Drugs → The following
should be present:

↳ should ↑↑ in cavernosal artery Diameter
By more than 75% from is Flaccid Baseline

↳ The peak Systolic Flow velocity →
should be at least 25 cm/sec in order to
Exclude arterial Disease

↳ The acceleration time is determined
which the systolic time during which
The Blood flow velocity Reach its peak

- It may be prolonged in arteriogenic ^⑤ ED

- The PPDU can simultaneously diagnose
The ED Nit → Corporo cavernous leakage
as follows:

↳ Normally: During the full erection phase
→ The intraCavernous Blood pressure →
Should equal or exceed the diastolic Bp
→ So the Blood enters the penis only
During the systole
and Blood Flow velocity During the diastole
should be near Zero

↳ Under Abnormal Condition → of
Corporo cavernous leakage the intraCavernous
pressure → may be less than the systemic
diastolic pressure

→ So the Blood Flow persist During the
diastole → 130

Diastolic flow velocity > 5 cm/sec.

- The other parameter derived from the diastolic flow velocity is the Resistance index = RI

$$= \frac{\text{Peak systolic velocity} - \text{Diastolic velocity}}{\text{Peak systolic velocity}}$$

- Because the Diastolic velocity = Zero under normal condition \rightarrow So the $RI = 1$, If there is Corporovenous leakage

- The Diastolic velocity > 5 cm/sec
- So the RI \rightarrow become less than 1

★ Advantages of ppDU :-

- 1- Its minimally invasive Test
- 2- It's The first line Test of choice in the Diagnosis of arteriogenic ED

3- It can Directly Diagnose Corporovenous ED

4- In contrast to arteriography that is invasive and gives only anatomical information

- The ppDU is Non-invasive and gives Functional information

\rightarrow Blood flow velocity
 \rightarrow acceleration Time

★ Disadvantages of ppDU

1- Variations D't pt'n's psychogenic Conditions

• the anxiety in some pt's \rightarrow lead to excessive Sympathetic Discharge that prevents complete response to ICI

this may lead to false Diagnosis of arteriogenic and CorporCavenogenic ED

- This may be overcome as mentioned before by the ICI Test

2 - Variations Due to patient's Anatomy:

- variations in the anatomy of Cavernosal artery in its position, number, abnormal Branching

↳ leads to → False Diagnosis of arteriogenic ED

- The narrowed segment of the artery may force the blood in a high velocity giving a false impression of being Normal velocity

↳ This is termed "Stenosis acceleration"

3 - Variations Due to the timing of The Test:

- The Test should be Done 5 minutes after the ICI for proper detection of arterial flow → as this flow will ↓↓ During the following phase of full erection.

- On The other Hand → the evaluation of CorporoCavernous occlusion should

Not be Done except During the full (7) erection phase.

4 - Variations Due to Technique of The Test:

- The test may vary according to the

- experience of the operator
- The position of the probe of the device on the penis (That should be proximal before arterial Branching and the angle of the application)

• [MRI]

- Some studies shows → Significant difference in the MRI picture of the flaccid penis Between The potent males and males with ED

- This is in the need for evaluations before it can be used as a routine Test in The clinical practice.

2 Invasive Test:-

[Arteriography]

- Indications: the invasive test is indicated only as a preoperative investigation in the ptn who will undergo →

Penile revascularization to detect the localized arterial stenosis lesions

- e.g: Post-Traumatic

- It's thus indicated only in relatively small number of the ptns.

- Technique:-

- The Test is Done By:- ICI of Vasoactive Drugs

- Followed By → Selective Cannulation of the internal iliac artery or the internal pudendal artery → and injection of Diluted contrast Solution to visualize

The Anatomy and Radiographic appearance of the Cavernosal arteries.

- I.V Diazepam or General Anesthesia
→ may needed in some anxious ptns to avoid → False abnormal Results.

Due to pain or excessive Sympathetic Tone → that more occur in about 50% of ptns.

[Radioisotopes penography]

- These Tests depends on the Evaluation of the penile Blood flow By the use of Radioisotopes

- The Examples include:


1. → Penile Blood pooling studies eⁿ technetium-labelled RBCs and ICI of Vasodilators

2. → Penile washout studies with

② Doppler wave form analysis :-

- measure the Blood flow velocity in the penile arteries
- But it can't detect the cavernosal arteries flow.
- It detect the flow in the Dorsal artery that has minimal relation to the erection

exercise and a difference of more than 0.15 \rightarrow indicates pelvic Steal Syndrome

 all these tests can't detect exactly the artery that is examined

- if ϕ Diameter or any stenotic lesion
- Also it's Done in the plecid state \rightarrow

D. Treatment of atherogenic ED

A. Non-Surgical

→ Specific tte:

- Directed towards the correction of any of above causes
- Such stoppage of smoking
- Diabetic control
- Correction of Hyperlipidemia

→ Non-Specific tte

- Oral medication
- Vacuum Constriction Devices
- ICI Therapy (most preferred)
- The Dose has to ↑↑ in order to get an adequate erectile Response

Surgical

→ Specific tte: (Revascularization)

- depends on penile revascularization operations that have specific indications that are found in very few ptns

Indications:

- age < 60 yr
- Absence of DM or diffuse arterial Disease
- Absence of Delay in the Response to ICI
- Absence of Corporal Cavernous Dysfunction
- Absence of Blood Flow of more than 30 cm/sec During PPDV Test

Non-specific tte (Prosthesis implant)

- indicated in the ptns @
 - ↳ Severe diffuse arterial Disease
 - ↳ Heavy smokers - diabetics
 - ↳ ptns failed etc.

- the different types of operations include:

- The inferior epigastric artery → taken as the new arterial source → anastomosed directly to the corpus Cavernosum that was associated w/ High Failure Rate.

- It was modified in which the inferior epigastric artery anastomosed to Dorsal penile artery

- ↳ In this case → The Blood will pass retrograde from dorsal penile artery to pudendal a.

- Angiographic evidence of Localized Stenosis arterial lesions as occurs after Trauma.

II Corporo Venous ED

A Terminology :-

- ED :- Caused By any Disease That Disturb The Corporo Venous - Occlusive mechanism [Corporo venous leakage] In the presence of - normal arterial filling

- There is failure to store Blood and to maintain the erection.

- Few people pts in whom there is Congenital abnormal Venous Drainage

- most pts have abnormal Drainage from the veins as well as Corpora Cavernosa

↓
The correction term [Corporo venous leakage]

B Aetiology Types:

• Type 1:

- The cause is Congenital abnormal venous Drainage
- Seen in :- Young males & try ED

• Type 2:-

- The cause is abnormal Tunica Albuginea
- occur in: Aging - Trauma in erect penis - DM - Peyronie's Disease

• Type 3:-

- The cause → abnormal Cavernous Smooth muscles
- Due to → Fibrosis or Degeneration leading to → Incomplete relaxation with Incomplete expansion of Blood Sinusoids
- occur D.t → Aging - Hypercholesterolemia

• Type 4:-

- The Cause is inadequate release of the Neurotransmitters such as
 - neurogenic • psychogenic • diabetic ED • Heavy smokers.

• Type 5:-

- The Cause is Acquired abnormal Venous Drainage
 - It may occur after shunt operations for priapism or after Transurethral Surgery.

* Combined arteriogenic or Corporo-venogenic ED:-

- occur in: Old age, Smokers, hypertensive, diabetics, Hyperlipidemia
- may constitute upto 80% of Cases of ED

(C) Diagnosis :-

- General Diagnostic Scheme for all Ptns w ED is followed:

a. History :-

- good erection → lost Rapidly Not maintained
- History of possible Causes → may found.

b. Examination :-

- evidence of peyronie's Disease or penile scarring Due to previous Shunt operation for priapism.

c. Differentiation Between Organic - psychogenic

Factors:-

ICI + CIS Tests

- show early occurrence of Rigid erection
- lasts < 5 minutes

Rigiscan test

- evidence of Organic ED in the form of ↓↓ in the Duration or the Rigidity of Erectile episodes

d. Detection of Corporovenous Causes :-

1- Non-invasive Tests:-

[Pharmacopenile duplex US PPDU]

- PPDV gives Variable Results That depend upon the Type - Dose of the Intracavernous Drug. \Rightarrow to ensure Max. Sinusoidal dilatation \Rightarrow Required for venous occlusion.

- achieved By :- High Doses of multiple Drugs + use of CIS

- Its minimally invasive Test \Rightarrow Has good correlations with Cavernosometry and Cavernosography

2. Invasive Tests:-

[pharmaco Cavernosometry - Cavernosography]

* Indications:

- indicated in ptns w/ evidence of Corporvenous ED from the previous test and Candidate for Venoligation Surgery

as in ptn suspected to have Congenital abnormal venous ~~pressure~~ Drainage (13)

* Technique:

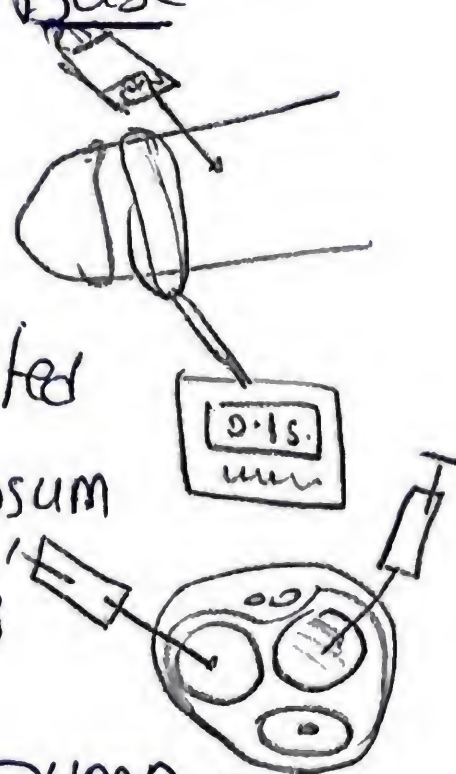
- 21-gauge Butterfly needles \rightarrow Inserted into One Corpus Cavernosum

- 0.5 mL of mixture of \rightarrow papaverine
injected after placing a \rightarrow Phentolamine
 \rightarrow PGE2
Rubber Band around The Penile Base to prevent Rapid washout of the Drug and Removed after 2 min.

- Another Butterfly needle is inserted into the opposite Corpus Cavernosum

Connected to BP monitoring

- Saline is infused through a pump or by gravity from infusion set at a rate of 60-120 ml/minutes for the Induction of erection.



- Once the intracavernous pressure \rightarrow Stable at 90 mmHg \rightarrow The rate of saline infusion is determined and considered as Maintenance Flow

because The arterial Punctions Can⁽¹⁴⁾ be evaluated by the PPDu \rightarrow There is No need to Determine it

- after that \rightarrow The saline infusion is $\uparrow\uparrow$ to raise The Corporal pressure above 150 mmHg. Then the infusion is Stopped to detect the pressure decline over 30 sec.

- Cavernosography \rightarrow Done By injection of 60 mL of Diluted Radiographic Contrast
- Sufficient films are taken to detect the presence or absence • Location of Corporovenous leakage
- The ptn should closely monitored after The Test \rightarrow for possible prolonged erection.

* Penile Systolic occlusion pressure:

determined By doppler examination During Performing Cavernosometry.

* Interpretation of The Results

- after repeated Dosages & Combinations of Vasoactive Drugs. are used to ensure Complete sinusoidal relaxations

- The Following parameters should detected:-

\rightarrow normal maintenance flow rate should be $< 5 \text{ ml/min}$

\rightarrow The normal pressure decline should be $< 45 \text{ mmHg}$ in 30 sec.

\rightarrow The induction Rate is not important as it depends on penile Size

\rightarrow Cavernosographic Visualization of The possible Abnormal veins That appear draining The Corpora During erection in the glans • C. spongiosum, deep dorsal vein

① Treatment :- of Corporo veno - Occlusive ED

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Non-Surgical ttt

→ ① Specific ttt :-

- Correction of any underlying Causes
- Physiotherapy → By electric stimulation and pelvic floor exercises of IschioCavernosus muscles for 4 months → improvement or Cure of the Condition in about 71% of the Ptns

→ Non-specific ttt :-

- ICI Therapy
- VCD

Surgical ttt

→ ① Specific ttt :-

- depends on Venoligation operations for the abnormal venous Drainage.
- The poor Results of Success 50% only
↳ The High Recurrence Rate
- The presence of the pathology in the Cavernous Tissue itself → lead to the Conclusion that these operations are NO longer being performed in most of the ptn.

→ ② Non-Specific ttt :-

- depends on implantation of penile prosthesis
- Indicated in ptn e' Severe Corporo venous ED or diffuse severe Disease as uncontrolled DM

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